



FCC PART 22H, PART 24E  
MEASUREMENT AND TEST REPORT

For

**Sinocastel Co.,Ltd.**

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China

**FCC ID: S8U213W**

<b>Report Type:</b> Original Report	<b>Product Type:</b> OBD Vehicle Tracking Device
<b>Report Number:</b>	RDG170718003-00B
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**Note:** This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.(Dongguan).

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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

The *Sinocastel Co.,Ltd.*'s product, model number: IDD-213W (**FCC ID: S8U213W**) (the "EUT") in this report was a OBD Vehicle Tracking Device, which was measured approximately: 6.4 cm (L) x 5 cm (W) x 2.8 cm (H), Rated power: DC3.7V from Battery or DC 9~36V. The device only supports data transmission, voice mode was disabled by the software.

*Note: The series product, model IDD-213EP and IDD-213W are electrically identical, the difference between them is model name, we selected IDD-213W for testing, the details was explained in the attached declaration letter.*

*All measurement and test data in this report was gathered from production sample serial number: 170718003 (Assigned by BACL, Dongguan). The EUT was received on 2017-07-18.*

### Objective

This report is prepared on behalf of *Sinocastel Co.,Ltd.* in accordance with: Part 2-Subpart J, Part 22-Subpart H, and Part 24-Subpart E of the Federal Communications Commission's rules.

The objective is to determine compliance with FCC Rules for output power, modulation characteristic, occupied bandwidth, spurious emissions at antenna terminal, spurious radiated emission, frequency stability and band edge.

### Related Submittal(s)/Grant(s)

N/A

### Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J, Part 22 Subpart H, Part 24 Subpart E.

Applicable Standards: TIA/EIA 603-D-2010.

All radiated and conducted emissions measurements were performed at Bay Area Compliance Laboratories Corp.(Dongguan).

### Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61 dB
Unwanted Emissions, radiated	30MHz ~ 1GHz: 5.85 dB 1G~26.5GHz: 5.23 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1 °C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%

### **Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China

Bay Area Compliance Laboratories Corp. (Dongguan) has been accredited to ISO 17025 by CNAS(Lab code: L5662). And accredited to ISO 17025 by NVLAP(Test Laboratory Accreditation Certificate Number 500069-0), the FCC Designation No. CN5002 under the KDB 974614 D01.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Bay Area Compliance Laboratories Corp. (Dongguan) was registered with ISED Canada under ISED Canada Registration Number 3062D.

## SYSTEM TEST CONFIGURATION

### Justification

The EUT was configured for testing according to TIA/EIA-603-D 2010.

The test items were performed with the EUT operating at testing mode.

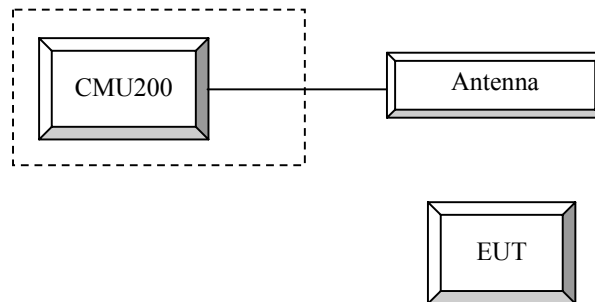
### Equipment Modifications

No modification was made to the EUT.

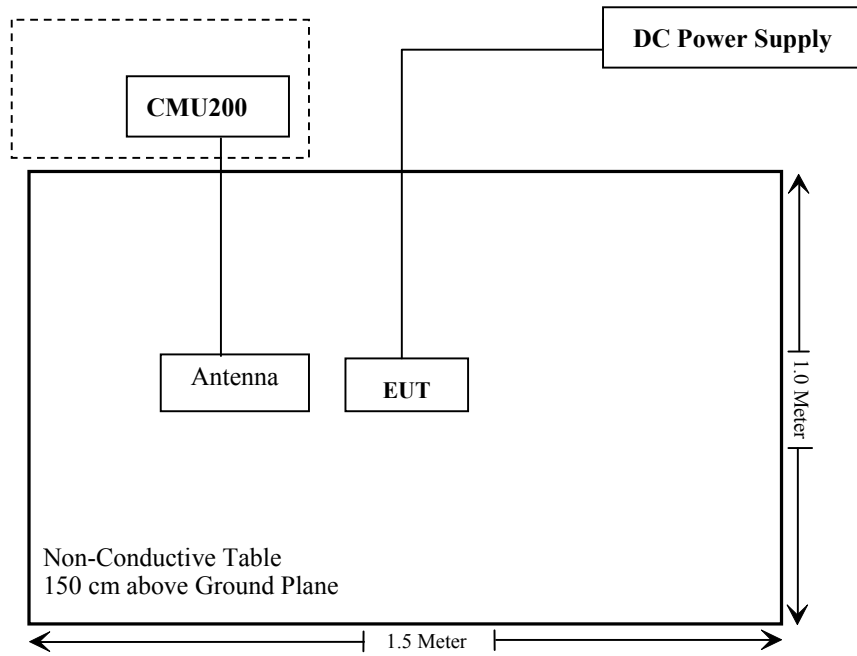
### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
R&S	Universal Radio Communication Tester	CMU200	109038

### Configuration of Test Setup



**Block Diagram of Test Setup**



**SUMMARY OF TEST RESULTS**

<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
FCC §1.1310 & §2.1091	Maximum Permissible Exposure (MPE)	Compliance
§2.1046; § 22.913 (a); § 24.232 (c)	RF Output Power	Compliance
§ 2.1047	Modulation Characteristics	Not Applicable
§ 2.1049; § 22.905 § 22.917; § 24.238	Occupied Bandwidth	Compliance
§ 2.1051, § 22.917 (a); § 24.238 (a)	Spurious Emissions at Antenna Terminal	Compliance
§ 2.1053 § 22.917 (a); § 24.238 (a)	Field Strength of Spurious Radiation	Compliance
§ 22.917 (a); § 24.238 (a)	Out of band emission, Band Edge	Compliance
§ 2.1055 § 22.355; § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Compliance



**FCC§1.1310 , §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

**Applicable Standard**

According to subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission’s guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minutes)
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; \* = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

**Calculation Formula:**

Prediction of power density at the distance of the applicable MPE limit:

$S = PG/4\pi R^2$  = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

**Calculated Data:**

Mode	Frequency (MHz)	Antenna Gain		Tune-up Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
		(dBi)	(numeric)	(dBm)	(mW)			
GSM850	824-849	-1	0.79	34	2511.89	20.00	0.3971	0.55
PCS1900	1850-1910	1	1.26	30	1000.00	20.00	0.25	1.0
WCDMA Band V	824-849	-1	0.79	24	251.19	20.00	0.04	0.55
WCDMA Band II	1850-1910	1	1.26	24	251.19	20.00	0.06	1.0

**Result: Compliance,** The device meets MPE requirement for Devices Used by the General Public (Uncontrolled Environment) at distance ≥20 cm.

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## **FCC §2.1047 - MODULATION CHARACTERISTIC**

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According to FCC § 2.1047(d), Part 22H & 24E, there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

## **FCC § 2.1046, § 22.913 (a) & § 24.232 (c) - RF OUTPUT POWER**

### **Applicable Standard**

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to FCC §2.1046 and §24.232 (C), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications..

According to §24.232 (d) Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

### **Test Procedure**

#### **GSM/GPRS/EGPRS**

Function: Menu select > GSM Mobile Station > GSM 850/1900

Press Connection control to choose the different menus

Press RESET > choose all the reset all settings

Connection Press Signal Off to turn off the signal and change settings

Network Support > GSM + GPRS or GSM + EGSM

Main Service > Packet Data

Service selection > Test Mode A – Auto Slot Config. off

MS Signal Press Slot Config Bottom on the right twice to select and change the number of time slots and power setting

> Slot configuration > Uplink/Gamma

> 33 dBm for GPRS 850

> 30 dBm for GPRS 1900

> 27 dBm for EGPRS 850

> 26 dBm for EGPRS 1900

BS Signal Enter the same channel number for TCH channel (test channel) and BCCH channel

Frequency Offset > + 0 Hz

Mode > BCCH and TCH

BCCH Level > -85 dBm (May need to adjust if link is not stable)

BCCH Channel > choose desire test channel [Enter the same channel number for TCH channel (test channel) and BCCH channel]

Channel Type > Off

P0 > 4 dB  
 Slot Config > Unchanged (if already set under MS signal)  
 TCH > choose desired test channel  
 Hopping > Off  
 Main Timeslot > 3  
 Network Coding Scheme > CS4 (GPRS) and MCS5 (EGPRS)

Bit Stream > 2E9-1 PSR Bit Stream  
 AF/RF Connection Enter appropriate offsets for Ext. Att. Output and Ext. Att. Input  
 Press Signal on to turn on the signal and change settings

**WCDMA-Release 99**

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification. The EUT has a nominal maximum output power of 24dBm (+1.7/-3.7).

<b>WCDMA General Settings</b>	Loopback Mode	Test Mode 1
	Rel99 RMC	12.2kbps RMC
	Power Control Algorithm	Algorithm2
	$\beta_c / \beta_d$	8/15

**WCDMA HSDPA**

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification.

	Mode	HSDPA	HSDPA	HSDPA	HSDPA
	Subset	1	2	3	4
<b>WCDMA General Settings</b>	Loopback Mode	Test Mode 1			
	Rel99 RMC	12.2kbps RMC			
	HSDPA FRC	H-Set1			
	Power Control Algorithm	Algorithm2			
	$\beta_c$	2/15	12/15	15/15	15/15
	$\beta_d$	15/15	15/15	8/15	4/15
	$\beta_d$ (SF)	64			
	$\beta_c / \beta_d$	2/15	12/15	15/8	15/4
	$\beta_{hs}$	4/15	24/15	30/15	30/15
MPR(dB)	0	0	0.5	0.5	
<b>HSDPA Specific Settings</b>	DACK	8			
	DNAK	8			
	DCQI	8			
	Ack-Nack repetition factor	3			
	CQI Feedback	4ms			
	CQI Repetition Factor	2			
	$A_{hs} = \beta_{hs} / \beta_c$	30/15			

**WCDMA HSUPA**

The following tests were conducted according to the test requirements outlines in section 5.2 of the 3GPP TS34.121-1 specification.

	<b>Mode</b>	<b>HSUPA</b>	<b>HSUPA</b>	<b>HSUPA</b>	<b>HSUPA</b>	<b>HSUPA</b>
	<b>Subset</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>WCDMA General Settings</b>	Loopback Mode	Test Mode 1				
	Rel99 RMC	12.2kbps RMC				
	HSDPA FRC	H-Set1				
	HSUPA Test	HSUPA Loopback				
	Power Control Algorithm	Algorithm2				
	$\beta_c$	11/15	6/15	15/15	2/15	15/15
	$\beta_d$	15/15	15/15	9/15	15/15	0
	$\beta_{ec}$	209/225	12/15	30/15	2/15	5/15
	$\beta_c/\beta_d$	11/15	6/15	15/9	2/15	-
	$\beta_{hs}$	22/15	12/15	30/15	4/15	5/15
	CM(dB)	1.0	3.0	2.0	3.0	1.0
MPR(dB)	0	2	1	2	0	
<b>HSDPA Specific Settings</b>	DACK	8				
	DNAK	8				
	DCQI	8				
	Ack-Nack repetition factor	3				
	CQI Feedback	4ms				
	CQI Repetition Factor	2				
	$A_{hs}=\beta_{hs}/\beta_c$	30/15				
<b>HSUPA Specific Settings</b>	DE-DPCCH	6	8	8	5	7
	DHARQ	0	0	0	0	0
	AG Index	20	12	15	17	21
	ETFCI	75	67	92	71	81
	Associated Max UL Data Rate kbps	242.1	174.9	482.8	205.8	308.9
	Reference E_FCIs	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27	E-TFCI 11 E-TFCI PO4 E-TFCI 92 E-TFCI PO 18	E-TFCI 11 E E-TFCI PO 4 E-TFCI 67 E-TFCI PO 18 E-TFCI 71 E-TFCI PO23 E-TFCI 75 E-TFCI PO26 E-TFCI 81 E-TFCI PO 27		

*Radiated method:*

ANSI/TIA-603-D section 2.2.17

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2016-09-01	2017-08-31
Sunol Sciences	Antenna	JB3	A060611-1	2014-11-06	2017-11-05
R&S	Spectrum Analyzer	FSU 26	200256	2016-12-08	2017-12-08
ETS LINDGREN	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
HP	Signal Generator	1026	320408	2016-12-08	2017-12-08
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
TDK RF	Horn Antenna	HRN-0118	130 084	2016-01-05	2019-01-04
Unknown	Coaxial Cable	ChamberA-1	14m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	Chamber B-2	8m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/
E-Microwave	DC Blocking	EMDCB-00036	0E01201047	2017-05-06	2018-05-06
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed traceable to National Primary Standards and International System of Units (SI).

**Test Data****Environmental Conditions**

<b>Temperature:</b>	25.4 °C
<b>Relative Humidity:</b>	53 %
<b>ATM Pressure:</b>	99.6 kPa

*The testing was performed by Leo Lv on 2017-08-03.*

**Conducted Output Power**

**Cellular Band (Part 22H) & PCS Band (Part 24E)**

Band	Channel No.	Conducted Output Power (dBm)							
		GPRS 1 TX Slot	GPRS 2 TX Slot	GPRS 3 TX Slot	GPRS 4 TX Slot	EDGE 1 TX Slot	EDGE 2 TX Slot	EDGE 3 TX Slot	EDGE 4 TX Slot
Cellular	128	33.16	30.35	28.56	27.41	27.36	24.52	22.89	21.70
	190	33.19	30.30	28.55	27.43	27.31	24.57	22.86	21.73
	251	33.17	30.28	28.53	27.40	27.32	24.56	22.84	21.71
PCS	512	29.63	26.77	25.01	23.92	25.55	22.90	20.57	19.42
	661	28.68	25.82	24.13	22.97	24.61	21.92	20.09	18.97
	810	27.21	24.42	22.67	21.50	23.32	20.56	19.63	18.47

**WCDMA Band II**

Mode	3GPP Sub Test	Average Output Power (dBm)					
		Low Channel (Ave. Power)	Low Channel (PAR)	Middle Channel (Ave. Power)	Middle Channel (PAR)	High Channel (Ave. Power)	High Channel (PAR)
Rel 99	1	22.30	2.74	20.98	3.73	20.39	3.49
HSDPA	1	21.75	2.71	21.31	3.83	20.05	3.40
	2	21.25	2.69	21.01	3.83	20.05	3.39
	3	21.25	2.69	21.91	3.82	19.85	3.52
	4	21.95	2.77	20.61	3.74	19.55	3.48
HSUPA	1	21.80	2.74	20.29	3.72	19.96	3.43
	2	22.00	2.64	19.99	3.73	19.66	3.58
	3	21.10	2.70	20.29	3.80	20.26	3.52
	4	21.40	2.66	21.09	3.66	19.56	3.41
	5	22.60	2.75	19.59	3.79	20.26	3.41
DC-HSDPA	1	21.20	2.64	21.30	3.82	20.46	3.39
	2	21.00	2.80	21.10	3.83	20.06	3.43
	3	21.70	2.76	21.00	3.77	19.16	3.47
	4	22.10	2.79	20.70	3.68	19.35	3.40
HSPA+	1	21.20	2.80	20.56	3.77	19.68	3.51

**WCDMA Band V**

Mode	3GPP Sub Test	Average Output Power (dBm)					
		Low Channel (Ave. Power)	Low Channel (PAR)	Middle Channel (Ave. Power)	Middle Channel (PAR)	High Channel (Ave. Power)	High Channel (PAR)
Rel 99	1	23.98	3.30	23.83	3.73	23.94	3.37
HSDPA	1	23.49	3.22	23.31	3.79	23.32	3.31
	2	23.50	3.37	23.25	3.78	23.41	3.41
	3	23.43	3.34	23.37	3.72	23.29	3.38
	4	23.45	3.39	23.39	3.80	23.37	3.36
HSUPA	1	23.91	3.23	23.76	3.68	23.85	3.44
	2	23.90	3.30	23.84	3.70	23.90	3.35
	3	24.00	3.20	23.84	3.71	23.79	3.30
	4	23.87	3.25	23.79	3.83	23.92	3.44
	5	24.00	3.26	23.68	3.78	23.88	3.34
DC-HSDPA	1	23.90	3.40	23.77	3.82	23.88	3.37
	2	23.95	3.21	23.71	3.81	23.85	3.30
	3	23.95	3.26	23.70	3.82	23.77	3.45
	4	23.88	3.35	23.74	3.72	23.79	3.35
HSPA+	1	23.84	3.29	23.76	3.67	23.91	3.46

Peak-to-average ratio (PAR)<13dB



## ERP &amp; EIRP

**Part 22H**

Frequency (MHz)	Polar (H/V)	Receiver Reading (dB $\mu$ V)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
<b>GSM 850_Middle Channel</b>								
836.600	H	101.73	33.8	0.0	0.5	33.3	38.5	5.2
836.600	V	95.87	31	0.0	0.5	30.5	38.5	8.0
<b>EDGE 850_Middle Channel</b>								
836.600	H	97.33	29.4	0.0	0.5	28.9	38.5	9.6
836.600	V	91.48	26.6	0.0	0.5	26.1	38.5	12.4
<b>WCDMA Band V Middle Channel</b>								
836.600	H	92.40	24.5	0.0	0.5	24.0	38.5	14.5
836.600	V	87.97	23.1	0.0	0.5	22.6	38.5	15.9

**Part 24E**

Frequency (MHz)	Polar (H/V)	Receiver Reading (dB $\mu$ V)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
<b>PCS 1900_Middle Channel</b>								
1880.000	H	89.93	17.3	11.7	2.7	26.3	33.0	6.7
1880.000	V	92.91	20.4	11.7	2.7	29.4	33.0	3.6
<b>EDGE 1900_Middle Channel</b>								
1880.000	H	87.85	15.2	11.7	2.7	24.2	33.0	8.8
1880.000	V	91.31	18.8	11.7	2.7	27.8	33.0	5.2
<b>WCDMA Band II Middle Channel</b>								
1880.000	H	81.87	9.3	11.7	2.7	18.3	33.0	14.7
1880.000	V	86.92	14.5	11.7	2.7	23.5	33.0	9.5

## Note:

- 1) The unit of Antenna Gain is dBd for frequency below 1GHz, and the unit of Antenna Gain is dBi for frequency above 1GHz.
- 2) Absolute Level = Substituted Level - Cable loss + Antenna Gain
- 3) Margin = Limit - Absolute Level

**FCC §2.1049, §22.917, §22.905 & §24.238 - OCCUPIED BANDWIDTH**

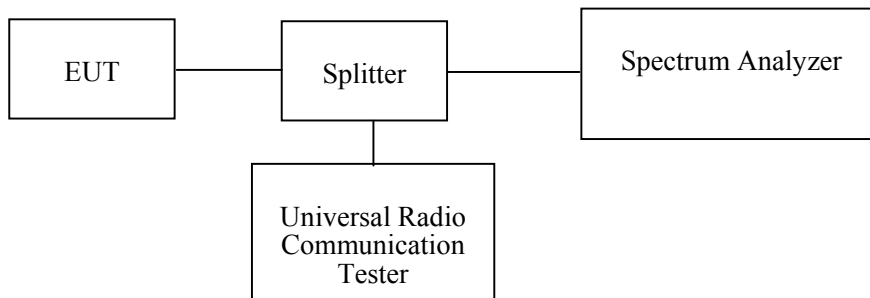
**Applicable Standard**

FCC §2.1049, §22.917 and §22.905, §24.238.

**Test Procedure**

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The 26 dB & 99% bandwidth was recorded.



**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2016-12-08	2017-12-08
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/
Pasternack	RF Coaxial Cable	0.5m	C-2	Each Time	/
E-Microwave	Two-way Splitter	ODP-1-6-2S	OE0120142	Each Time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed traceable to National Primary Standards and International System of Units (SI).

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	25.4~25.7°C
<b>Relative Humidity:</b>	53~54 %
<b>ATM Pressure:</b>	99.6 kPa

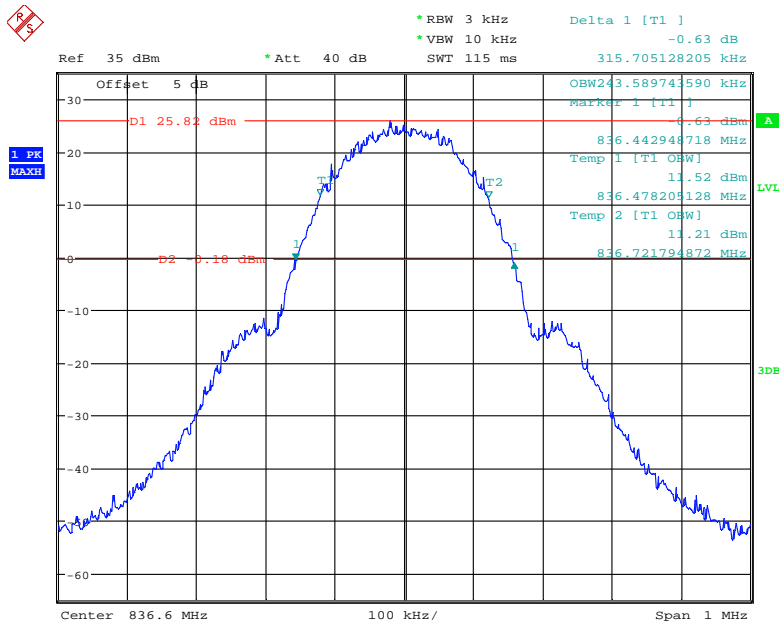
*The testing was performed by Leo Lv from 2017-08-02 to 2017-08-03.*

*Test Mode: Transmitting*

*Test Result: Compliant. Please refer to the following table and plots.*

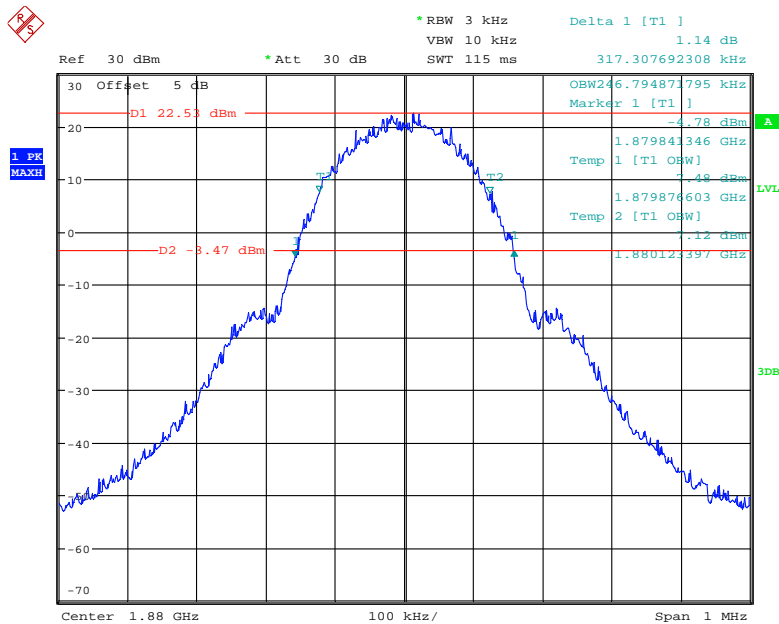
<b>Band</b>	<b>Test Channel</b>	<b>Mode</b>	<b>99% Occupied Bandwidth (MHz)</b>	<b>26 dB Occupied Bandwidth (MHz)</b>
Cellular	M	GPRS	0.244	0.316
		EDGE	0.245	0.317
PCS		GPRS	0.247	0.317
		EDGE	0.247	0.314
WCDMA Band II		Rel 99	4.054	4.647
		HSDPA	4.038	4.615
		HSUPA	4.054	4.647
WCDMA Band V		Rel 99	4.054	4.647
		HSDPA	4.054	4.647
		HSUPA	4.054	4.631

### GMSK 850 Cellular Band



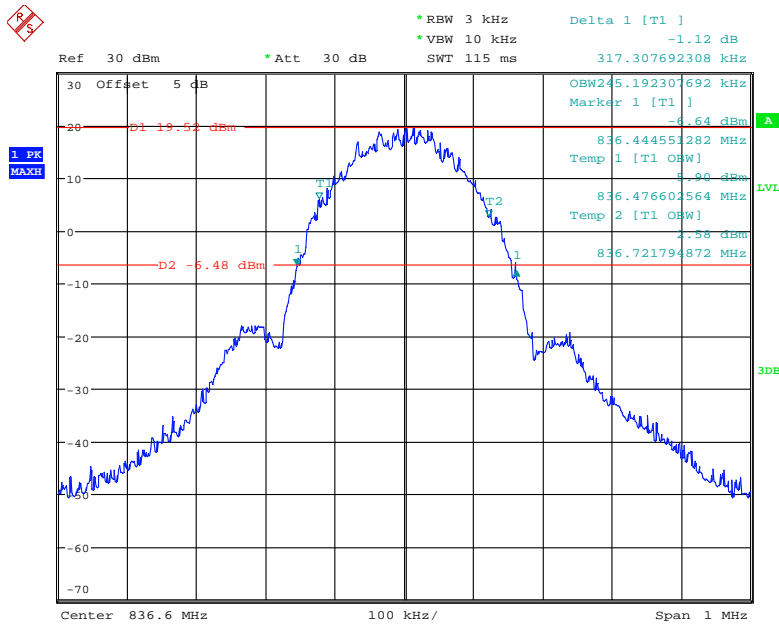
Date: 2.AUG.2017 23:10:29

### GMSK PCS Band



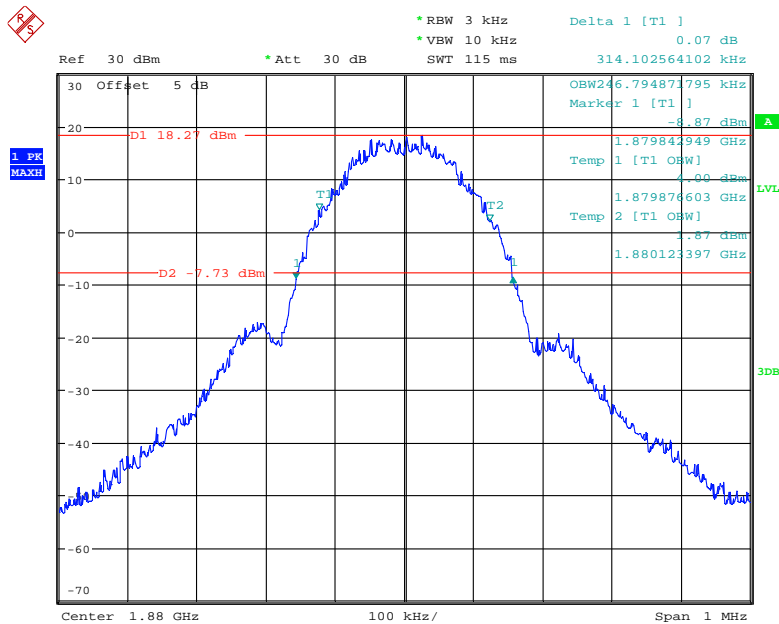
Date: 2.AUG.2017 22:17:02

### EDGE 850 Cellular Band



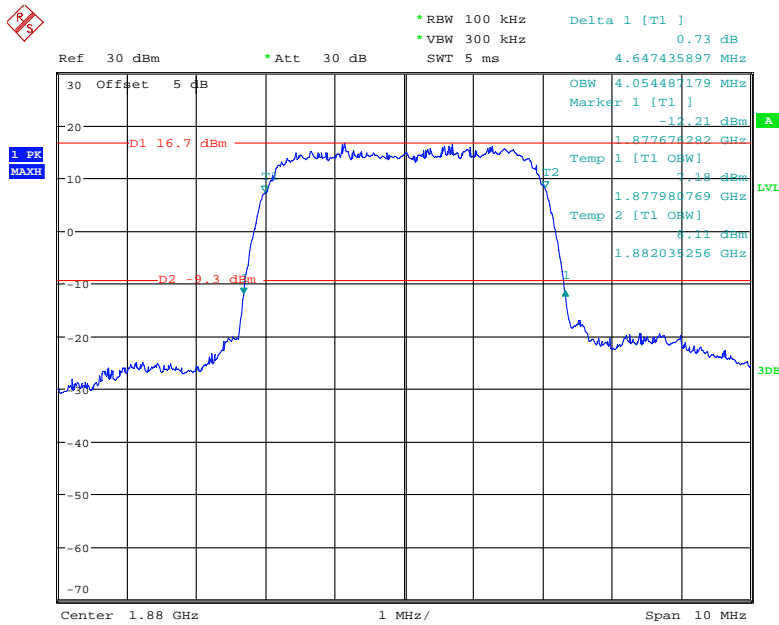
Date: 3.AUG.2017 00:08:34

### EDGE1900 PCS Band



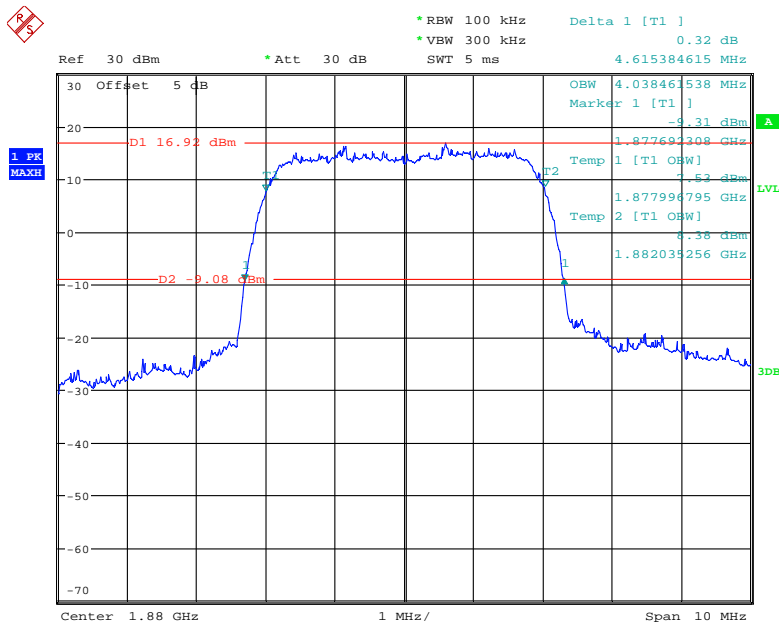
Date: 3.AUG.2017 00:16:17

### REL99 Band II



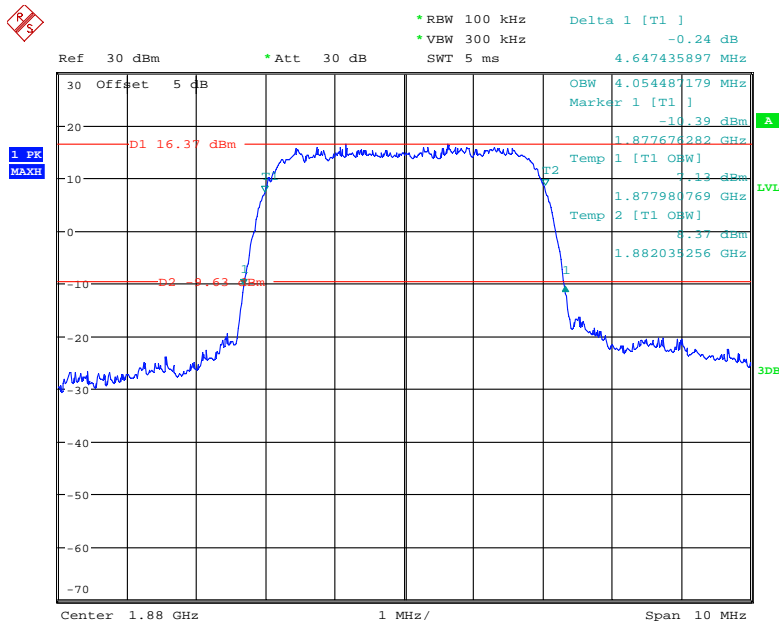
Date: 3.AUG.2017 20:32:50

### HSDPA Band II



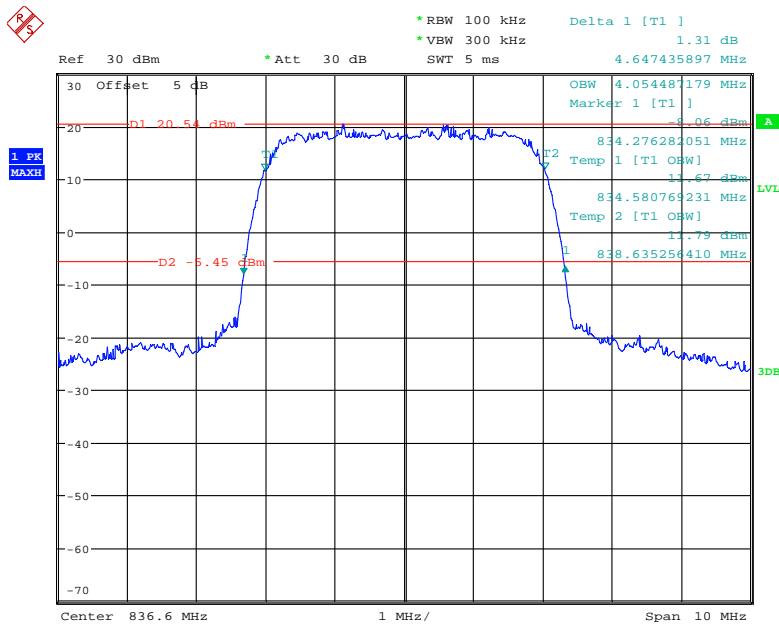
Date: 3.AUG.2017 20:42:26

### HSUPA Band II



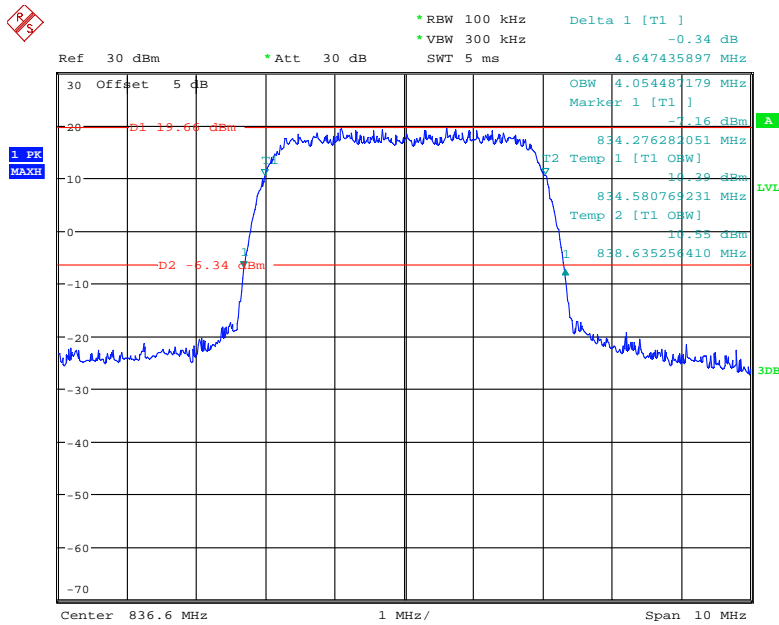
Date: 3.AUG.2017 21:12:46

### REL99 Band V



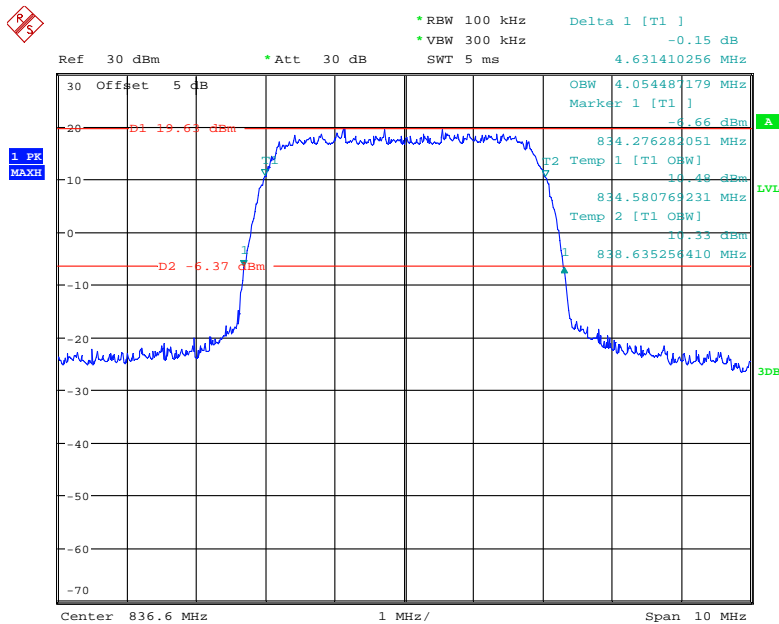
Date: 3.AUG.2017 21:27:30

### HSDPA Band V



Date: 3.AUG.2017 21:43:41

### HSUPA Band V



Date: 3.AUG.2017 21:52:59



## FCC §2.1051, §22.917(a) & §24.238(a) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

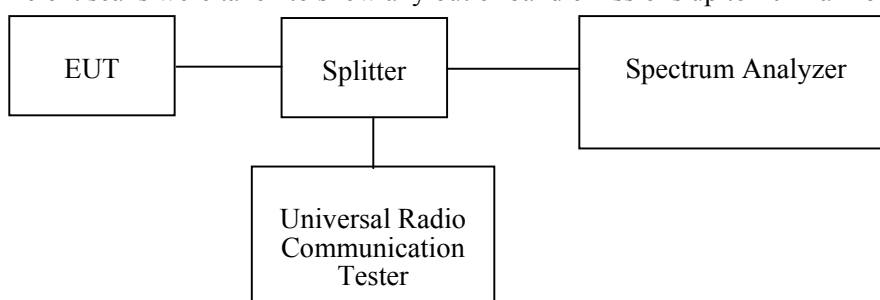
### Applicable Standard

FCC §2.1051, §22.917(a) and §24.238(a).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1051.

### Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.



### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2016-12-08	2017-12-08
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/
Pasternack	RF Coaxial Cable	0.5m	C-2	Each Time	/
E-Microwave	Two-way Splitter	ODP-1-6-2S	OE0120142	Each Time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed traceable to National Primary Standards and International System of Units (SI).

**Test Data**

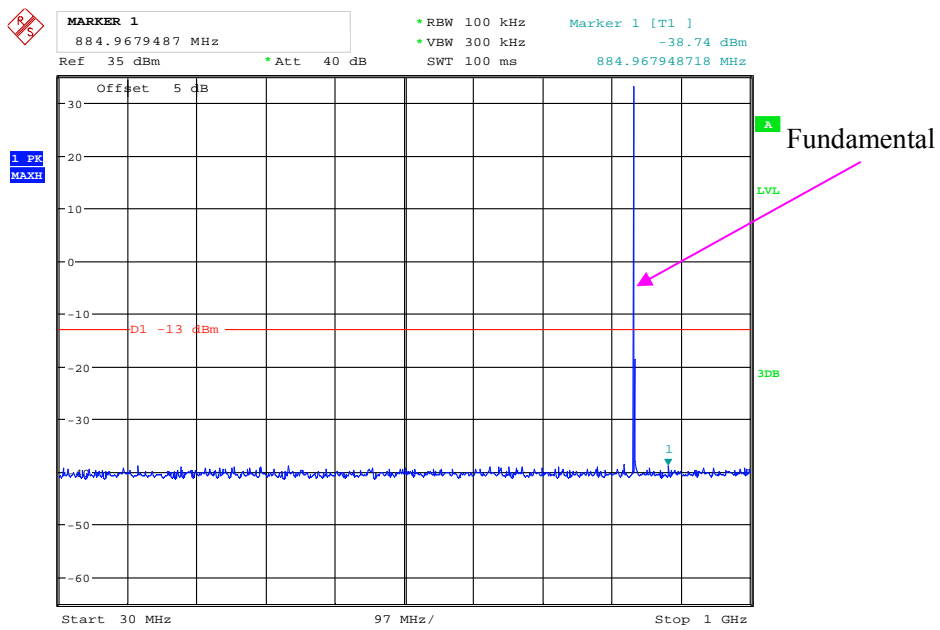
**Environmental Conditions**

<b>Temperature:</b>	25.4~26.5 °C
<b>Relative Humidity:</b>	49~53 %
<b>ATM Pressure:</b>	99.5~99.6 kPa

The testing was performed by Leo Lv from 2017-08-02 to 2017-08-10.

Please refer to the following plots.

**GSM850\_Middle Channel**

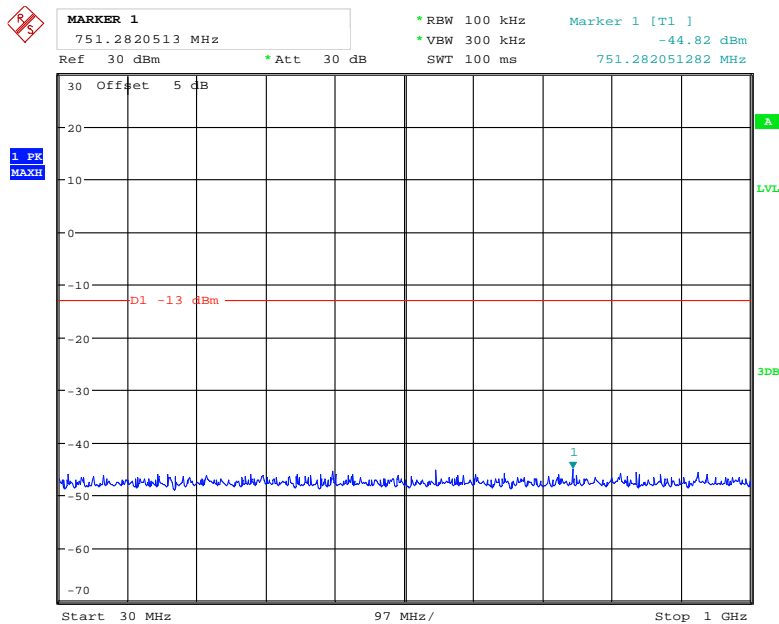


Date: 2.AUG.2017 23:04:47

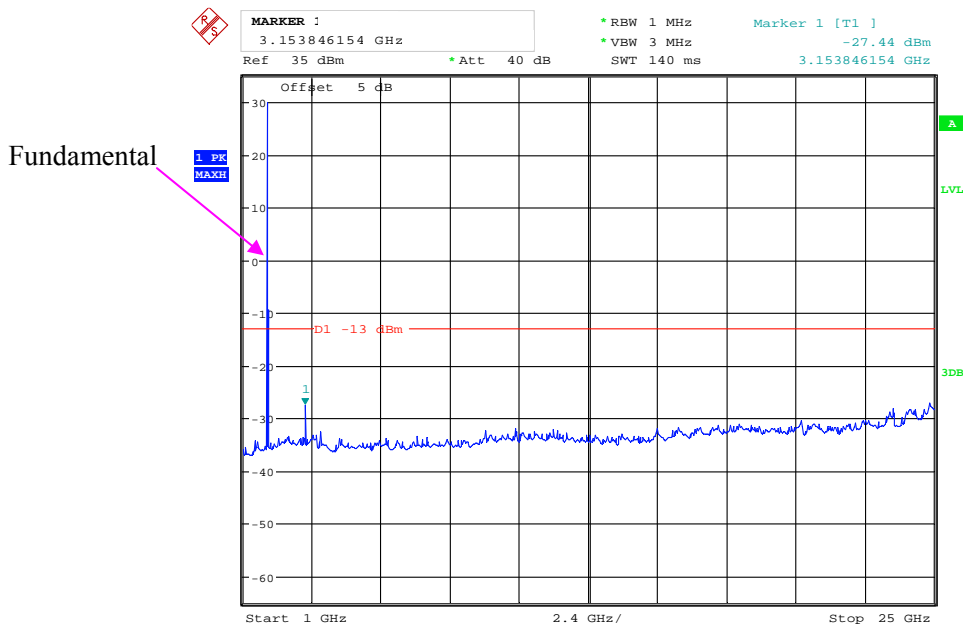


Date: 2.AUG.2017 23:05:27

### PCS 1900\_ Middle Channel

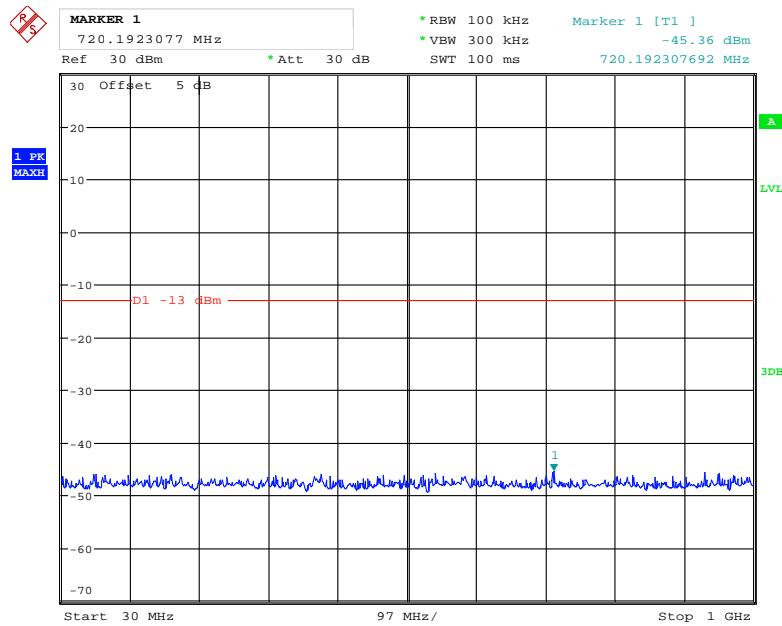


Date: 2.AUG.2017 22:33:47

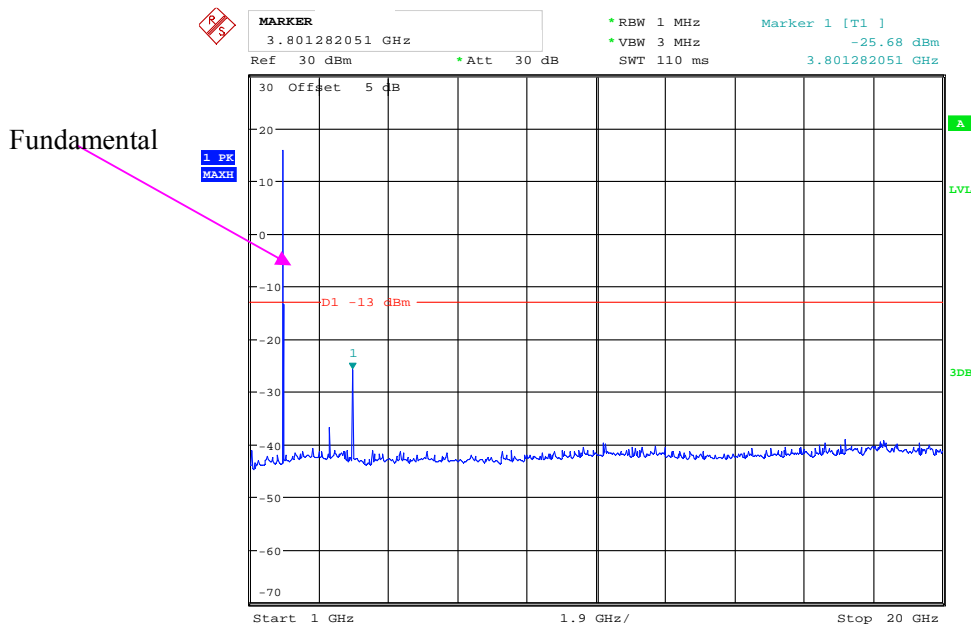


Date: 2.AUG.2017 22:35:18

### REL99 Band II\_Middle Channel

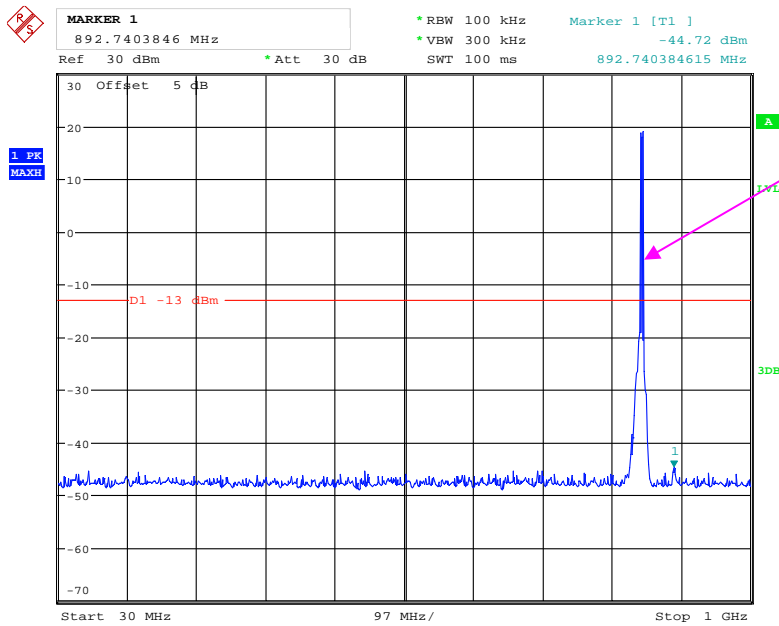


Date: 3.AUG.2017 20:37:16

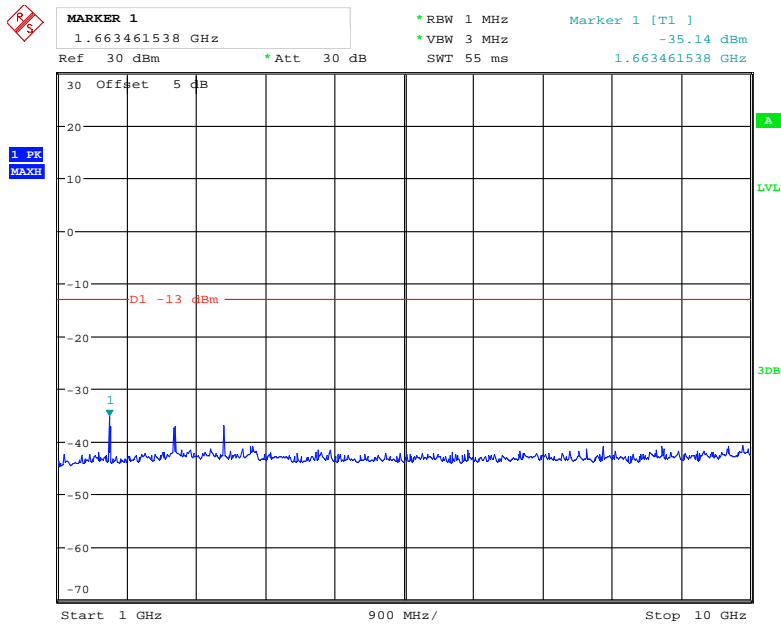


Date: 3.AUG.2017 20:11:54

### REL99 Band V\_Middle Channel



Date: 3.AUG.2017 21:31:50



Date: 10.AUG.2017 16:51:02

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**FCC §2.1053, §22.917 & §24.238 - SPURIOUS RADIATED EMISSIONS**

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**Applicable Standard**

FCC § 2.1053, §22.917 and § 24.238.

**Test Procedure**

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB =  $10 \lg(\text{TXpwr in Watts}/0.001)$  – the absolute level

Spurious attenuation limit in dB =  $43 + 10 \text{Log}_{10}(\text{power out in Watts})$

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCI	100224	2016-09-01	2017-08-31
Sunol Sciences	Antenna	JB3	A060611-1	2014-11-06	2017-11-05
HP	Amplifier	8447E	2434A02181	2016-09-01	2017-09-01
R&S	Spectrum Analyzer	FSU 26	200256	2016-12-08	2017-12-08
ETS LINDGREN	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
Mini-Circuit	Amplifier	ZVA-213-S+	SN054201245	2017-02-19	2018-02-19
HP	Signal Generator	1026	320408	2016-12-08	2017-12-08
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
TDK RF	Horn Antenna	HRN-0118	130 084	2016-01-05	2019-01-04
Unknown	Coaxial Cable	Chamber B-1	14m	2016-09-01	2017-09-01
Unknown	Coaxial Cable	Chamber B-2	8m	2016-09-01	2017-09-01
Mini Circuit	High Pass Filter	VHF-3100+	31251	2017-05-06	2018-05-06
Mini Circuit	High Pass Filte	VHF-1200+	N/A	2017-05-06	2018-05-06
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-02 1304	2016-11-18	2019-11-18
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2016-09-06	2017-09-06

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed traceable to National Primary Standards and International System of Units (SI).

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	26.1 °C
<b>Relative Humidity:</b>	54 %
<b>ATM Pressure:</b>	99.8 kPa

*The testing was performed by Steven Zuo on 2017-07-27.*



EUT Operation Mode: Transmitting

**Cellular Band (PART 22H)**

**30 MHz-10 GHz:**

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
GSM850, Frequency:836.600 MHz								
1673.200	H	82.48	-31.7	10.6	0.7	-21.8	-13.0	8.8
1673.200	V	84.59	-30.2	10.6	0.7	-20.3	-13.0	7.3
2509.800	H	78.57	-34.4	13.1	1.2	-22.5	-13.0	9.5
2509.800	V	80.59	-32.5	13.1	1.2	-20.6	-13.0	7.6
3346.400	H	60.73	-49.9	13.8	1.6	-37.7	-13.0	24.7
3346.400	V	63.54	-47.2	13.8	1.6	-35.0	-13.0	22.0
578.500	H	32.500	-61.4	0.0	0.4	-61.8	-13.0	48.8
873.900	V	26.430	-58.3	0.0	0.5	-58.8	-13.0	45.8
WCDMA Band V R99, Frequency:836.600 MHz								
1673.200	H	79.71	-34.5	10.6	0.7	-24.6	-13.0	11.6
1673.200	V	80.26	-34.6	10.6	0.7	-24.7	-13.0	11.7
2509.800	H	64.98	-48	13.1	1.2	-36.1	-13.0	23.1
2509.800	V	65.25	-47.8	13.1	1.2	-35.9	-13.0	22.9
3346.400	H	47.13	-63.5	13.8	1.6	-51.3	-13.0	38.3
3346.400	V	46.36	-64.3	13.8	1.6	-52.1	-13.0	39.1
578.500	H	32.740	-61.2	0.0	0.4	-61.6	-13.0	48.6
873.900	V	26.890	-57.8	0.0	0.5	-58.3	-13.0	45.3

**PCS Band (PART 24E)**

**30 MHz-20 GHz:**

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
GSM1900, Frequency:1880.000 MHz								
3760.000	H	74.52	-34.3	13.8	1.6	-22.1	-13.0	9.1
3760.000	V	72.64	-36	13.8	1.6	-23.8	-13.0	10.8
5640.000	H	63.45	-42.6	14.0	1.3	-29.9	-13.0	16.9
5640.000	V	61.39	-44.5	14.0	1.3	-31.8	-13.0	18.8
578.500	H	32.570	-61.4	0.0	0.4	-61.8	-13.0	48.8
873.900	V	26.190	-58.5	0.0	0.5	-59.0	-13.0	46.0
WCDMA Band II, R99, Frequency:1880.000 MHz								
3760.000	H	61.76	-47	13.8	1.6	-34.8	-13.0	21.8
3760.000	V	62.67	-46	13.8	1.6	-33.8	-13.0	20.8
5640.000	H	57.65	-48.4	14.0	1.3	-35.7	-13.0	22.7
5640.000	V	58.49	-47.4	14.0	1.3	-34.7	-13.0	21.7
578.500	H	32.410	-61.5	0.0	0.4	-61.9	-13.0	48.9
873.900	V	26.320	-58.4	0.0	0.5	-58.9	-13.0	45.9

Note:

- 1) The unit of Antenna Gain is dBd for frequency below 1GHz, and the unit of Antenna Gain is dBi for frequency above 1GHz.
- 2) Absolute Level = Substituted Level - Cable loss + Antenna Gain
- 3) Margin = Limit-Absolute Level

**FCC §22.917(a) & §24.238(a) - BAND EDGES**

**Applicable Standard**

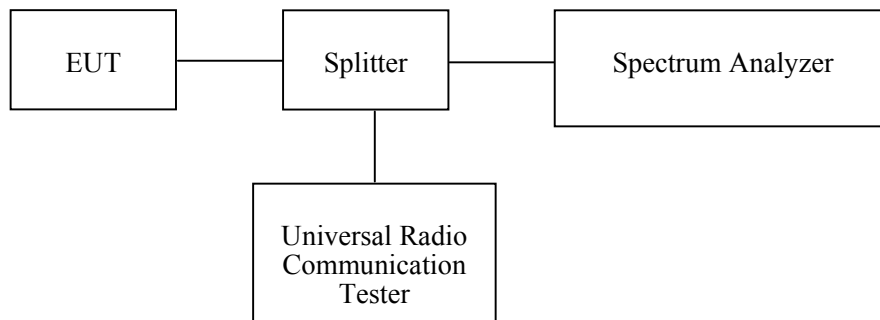
According to § 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

According to §24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

**Test Procedure**

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency.



**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSP 38	100478	2016-12-08	2017-12-08
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/
Pasternack	RF Coaxial Cable	0.5m	C-2	Each Time	/
E-Microwave	Two-way Splitter	ODP-1-6-2S	OE0120142	Each Time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed in accordance to NVLAP requirements, traceable to National Primary Standards and International System of Units (SI).

**Test Data**

**Environmental Conditions**

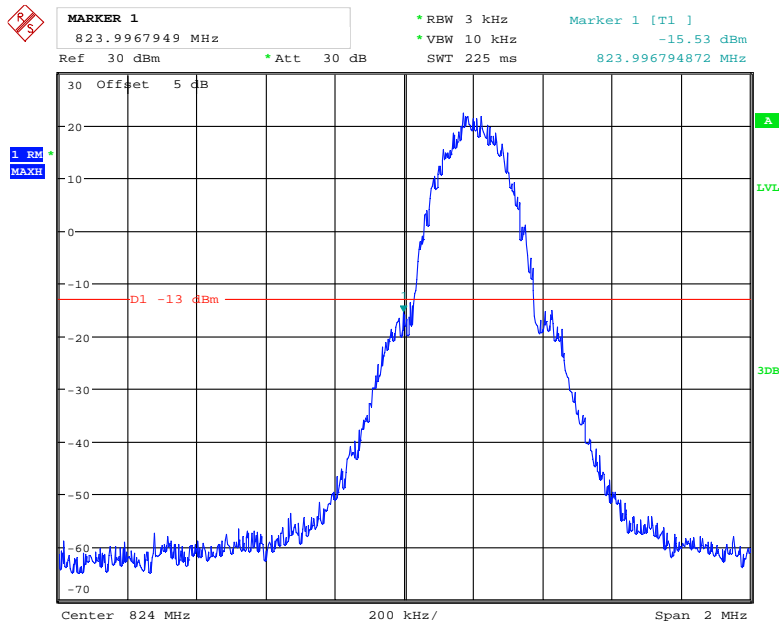
<b>Temperature:</b>	25.7~26.5 °C
<b>Relative Humidity:</b>	49~53 %
<b>ATM Pressure:</b>	99.5~99.6 kPa

*The testing was performed by Leo Lv from 2017-08-02 to 2017-08-10.*

*Test Mode: Transmitting*

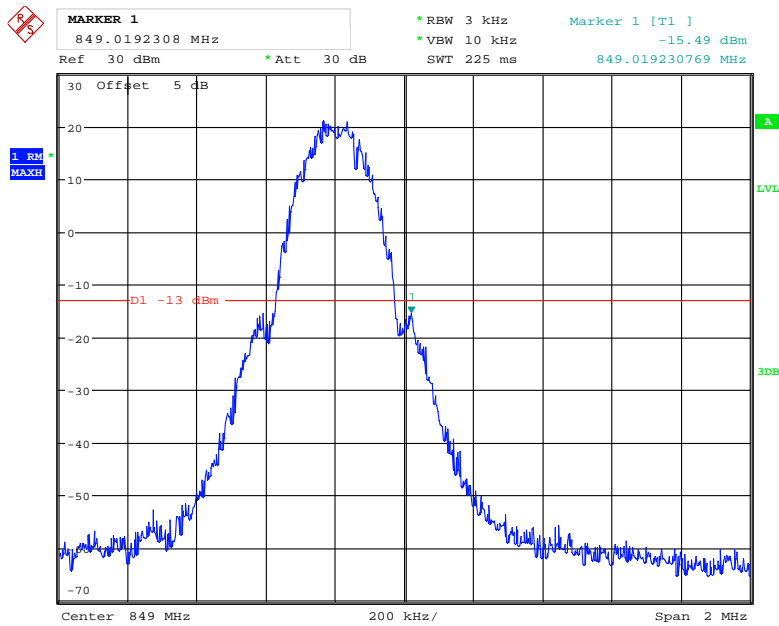
*Test Result: Compliant. Please refer to the following plots.*

### GSM 850, Left Band Edge



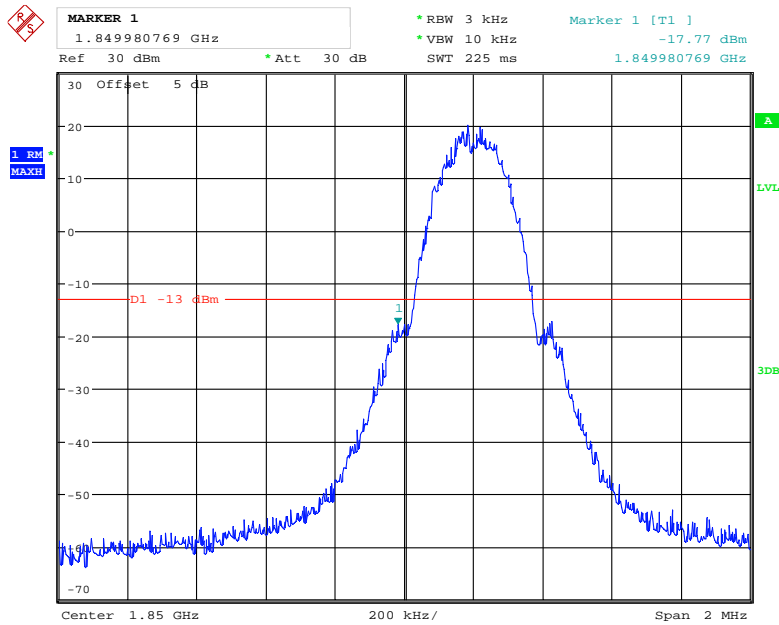
Date: 2.AUG.2017 23:15:50

### GSM 850, Right Band Edge



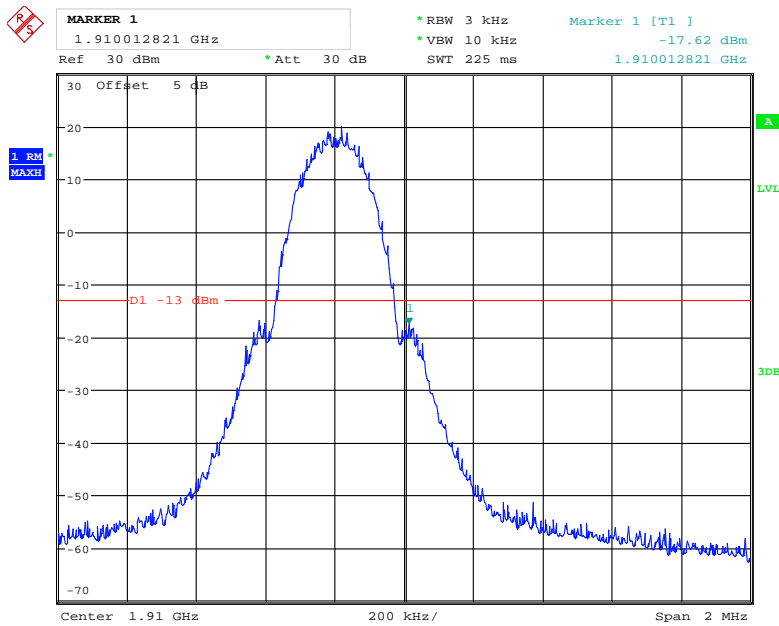
Date: 2.AUG.2017 23:14:43

### PCS 1900, Left Band Edge



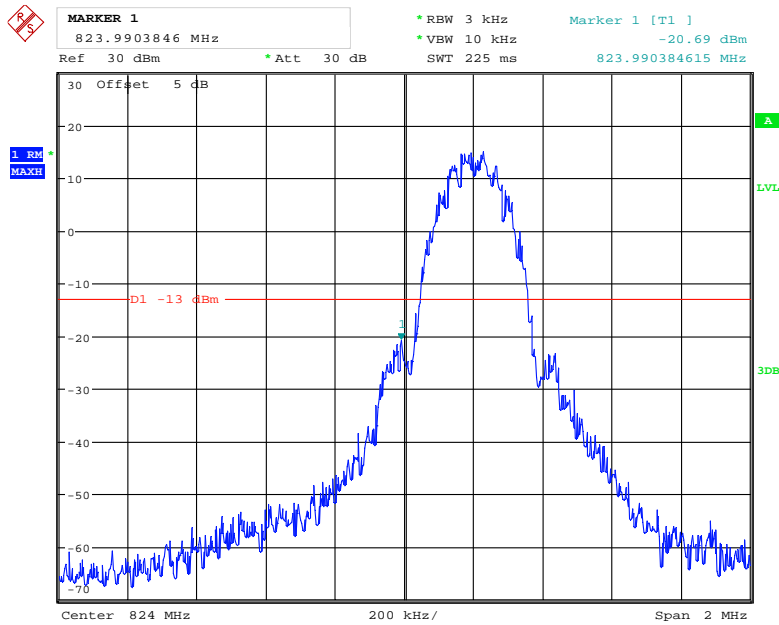
Date: 2.AUG.2017 22:25:11

### PCS 1900, Right Band Edge



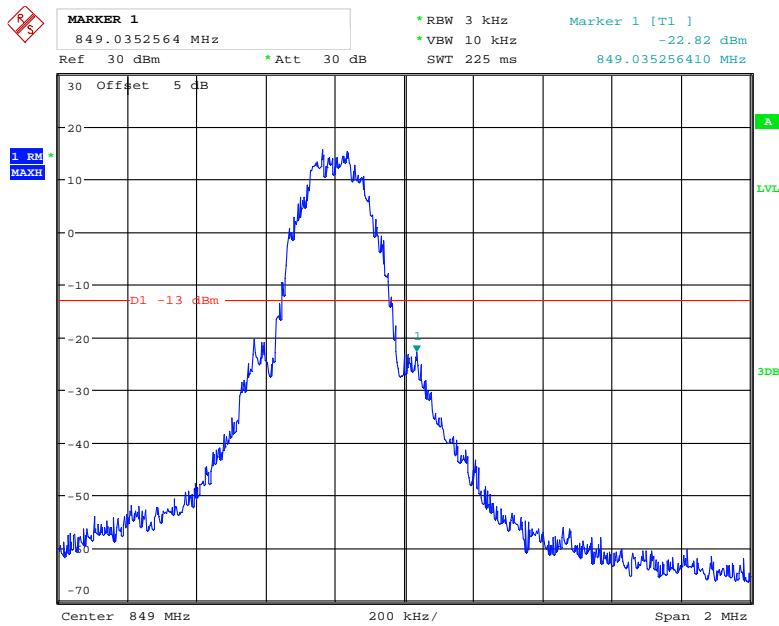
Date: 2.AUG.2017 22:31:35

### EDGE 850, Left Band Edge



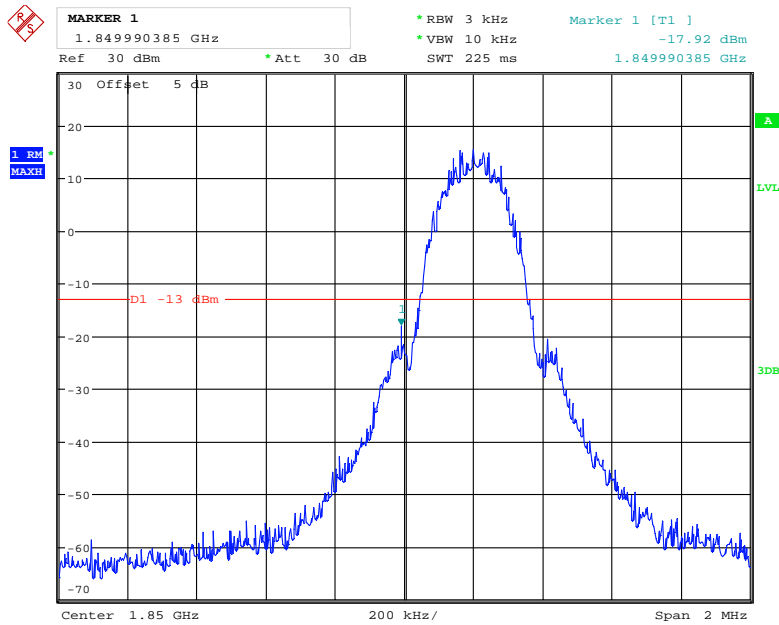
Date: 3.AUG.2017 00:04:24

### EDGE 850, Right Band Edge



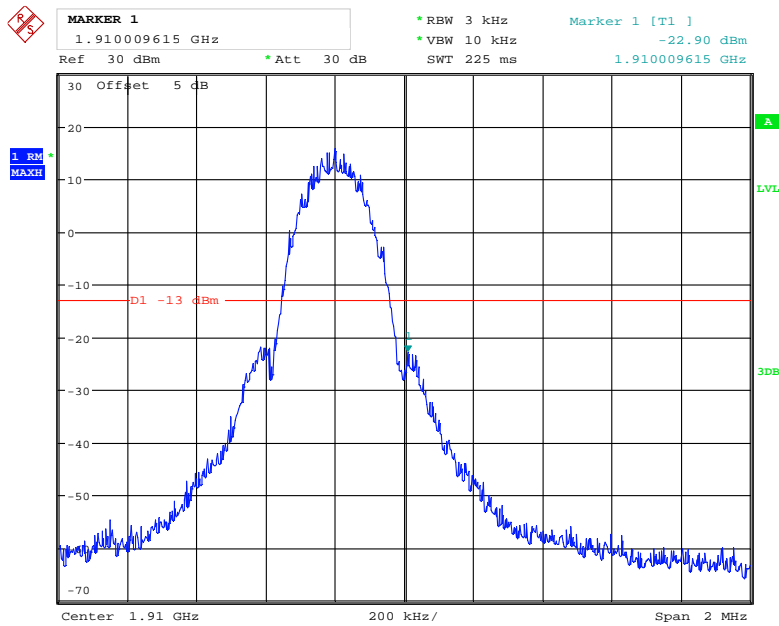
Date: 3.AUG.2017 00:05:43

### EDGE 1900, Left Band Edge



Date: 3.AUG.2017 00:20:02

### EDGE 1900, Right Band Edge

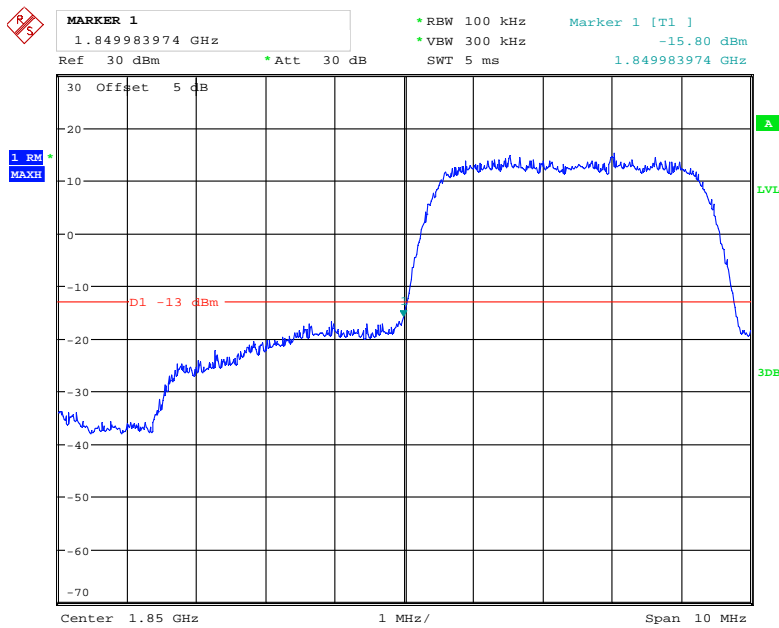


Date: 3.AUG.2017 00:21:36



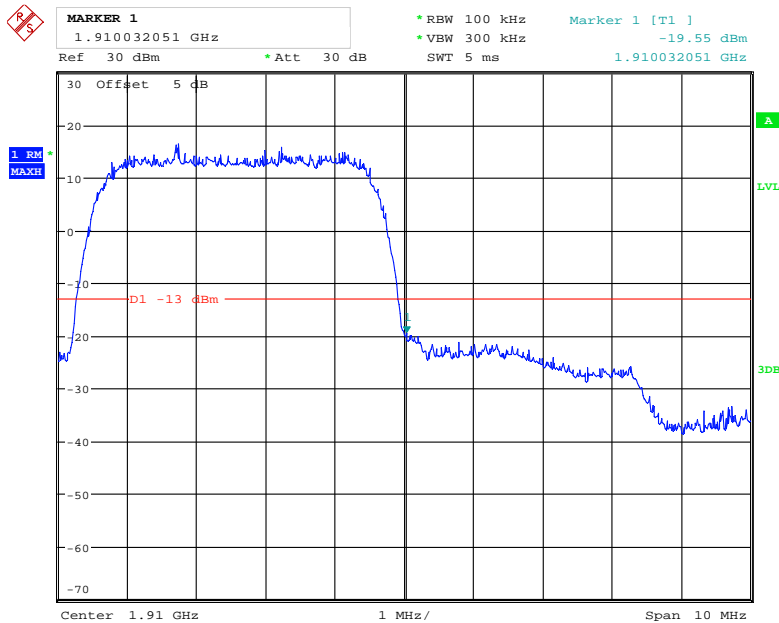
WCDMA Band II:

REL99 Band II, Left Band Edge



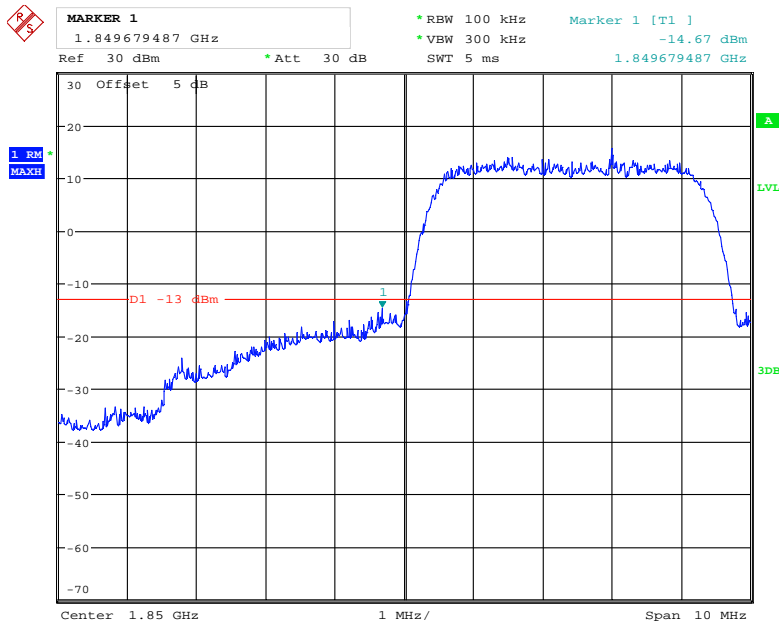
Date: 3.AUG.2017 20:35:11

REL99 Band II, Right Band Edge



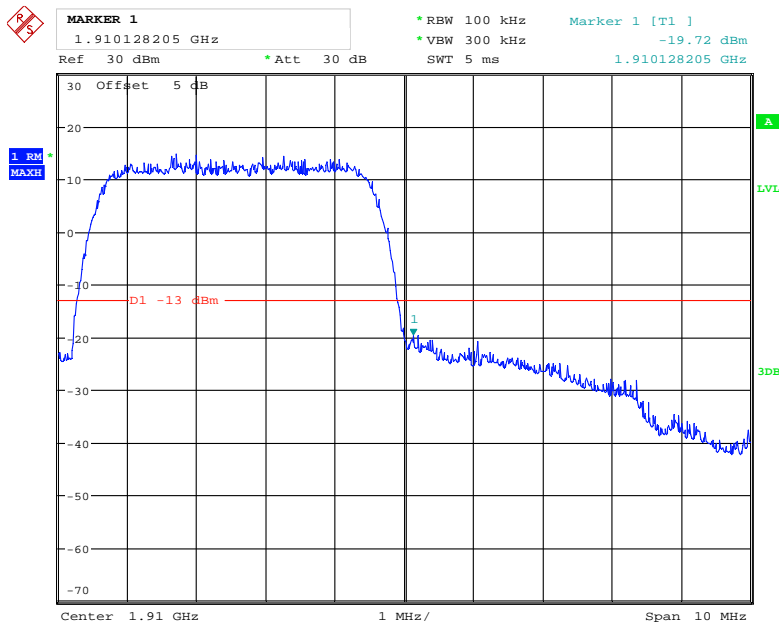
Date: 10.AUG.2017 16:52:42

### HSDPA Band II, Left Band Edge



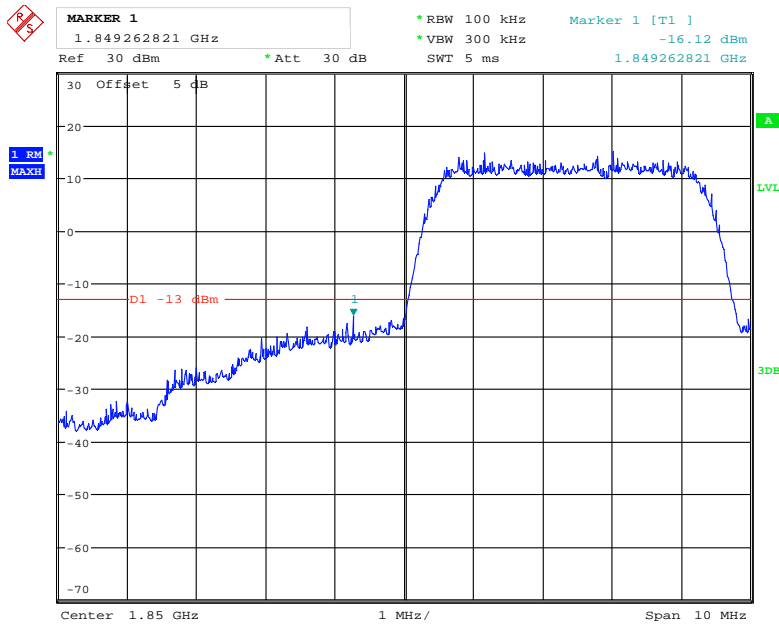
Date: 3.AUG.2017 20:44:44

### HSDPA Band II, Right Band Edge



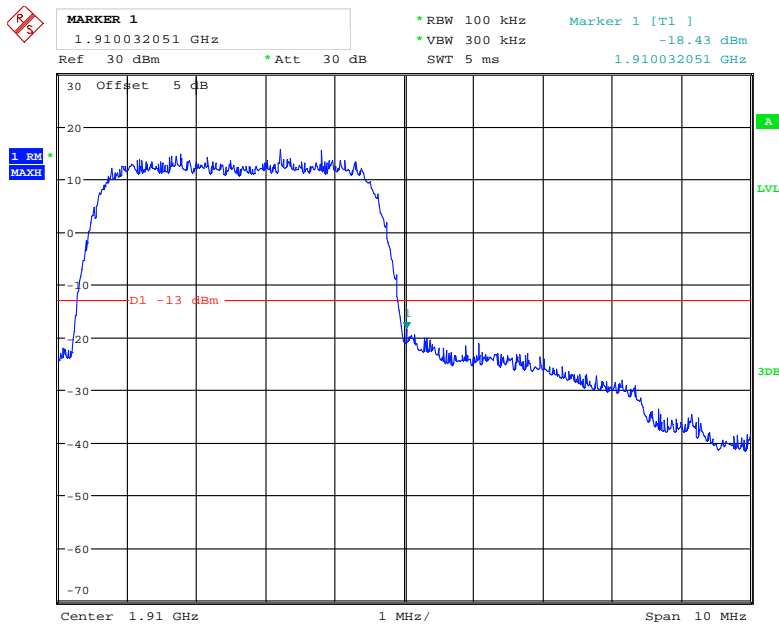
Date: 3.AUG.2017 20:46:03

### HSUPA Band II, Left Band Edge



Date: 3.AUG.2017 21:14:17

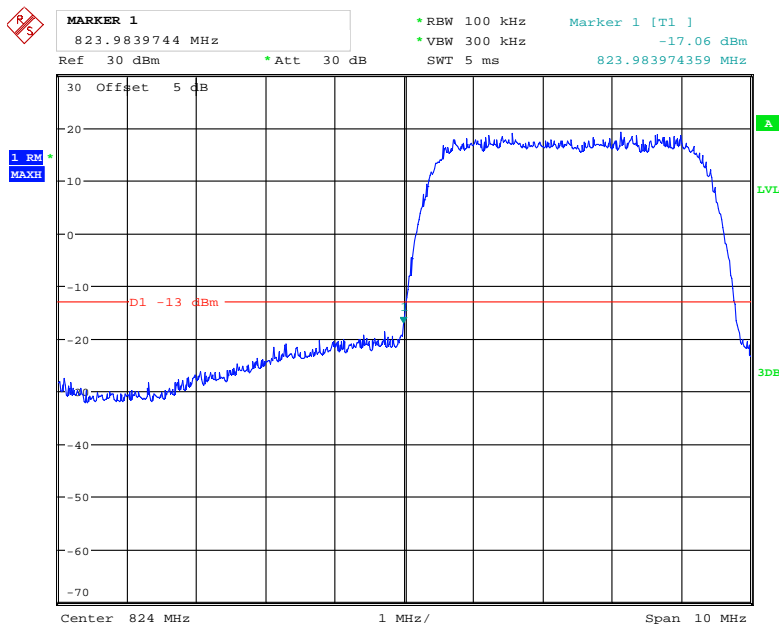
### HSUPA Band II, Right Band Edge



Date: 3.AUG.2017 21:17:08

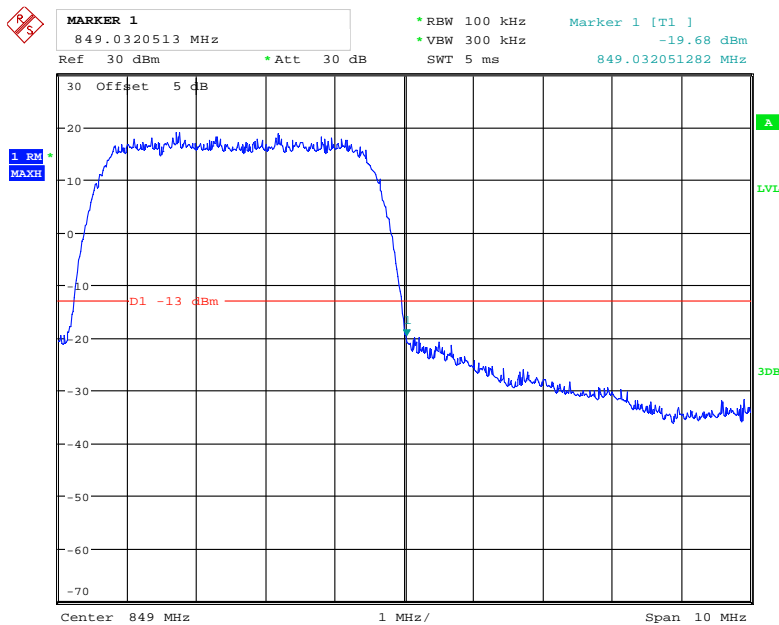
WCDMA Band V

REL99 Band V, Left Band Edge



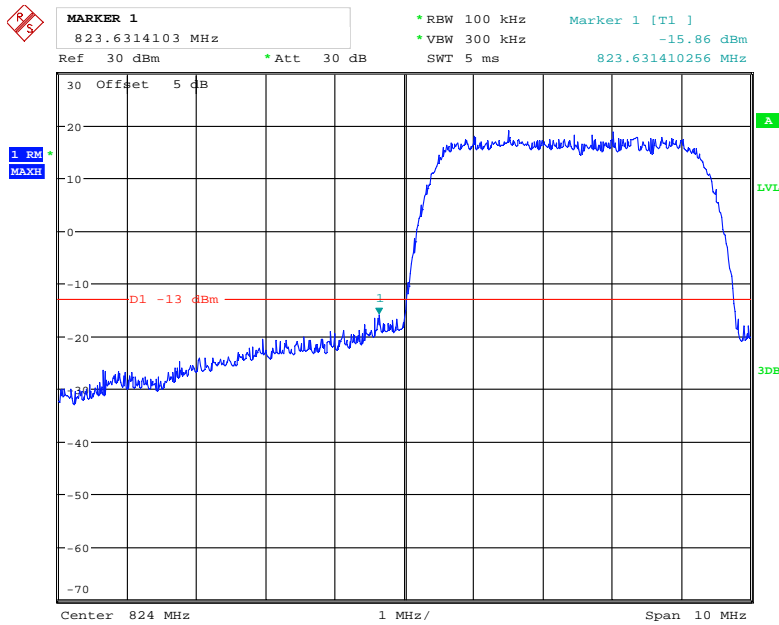
Date: 3.AUG.2017 21:29:02

REL99 Band V Right Band Edge



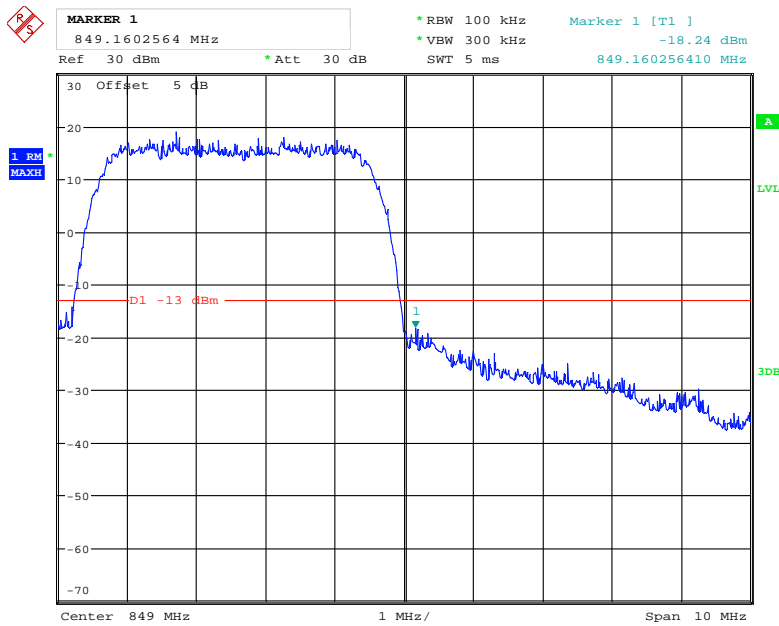
Date: 3.AUG.2017 21:30:26

### HSDPA Band V, Left Band Edge



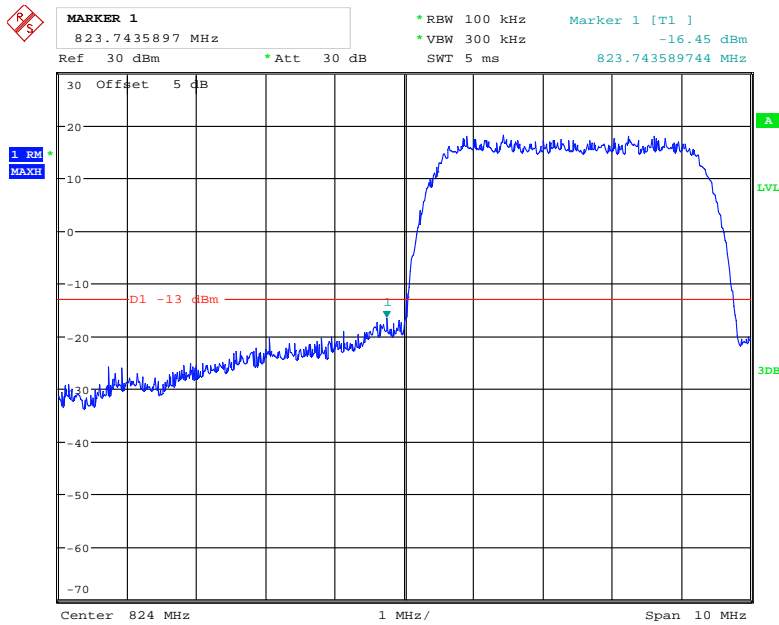
Date: 3.AUG.2017 21:45:28

### HSDPA Band V, Right Band Edge



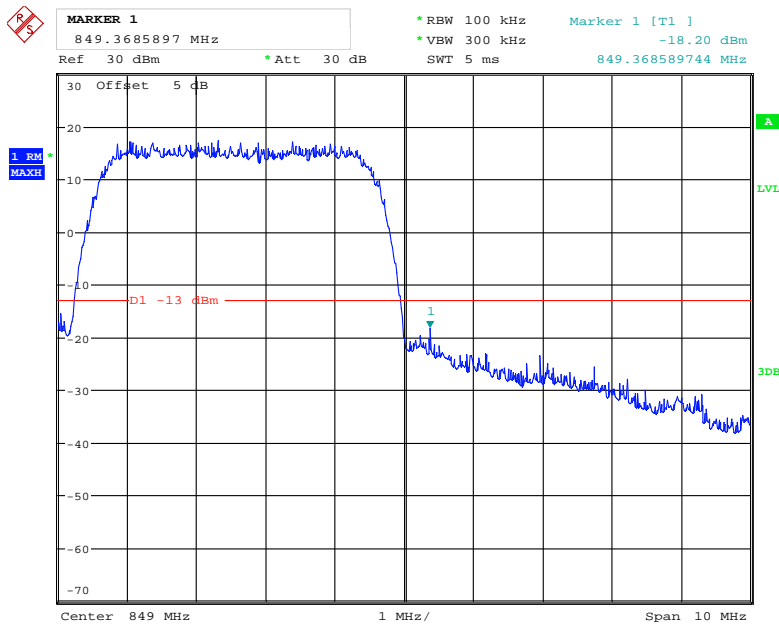
Date: 3.AUG.2017 21:46:34

### HSUPA Band V, Left Band Edge



Date: 3.AUG.2017 21:54:38

### HSUPA Band V, Right Band Edge



Date: 3.AUG.2017 21:55:22

**FCC §2.1055, §22.355 & §24.235 - FREQUENCY STABILITY**

**Applicable Standard**

FCC § 2.1055 (a), § 2.1055 (d), §22.355, §24.235

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:

Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency Range (MHz)	Base, fixed (ppm)	Mobile > 3 watts (ppm)	Mobile ≤ 3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929.	5.0	N/A	N/A
929 to 960.	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

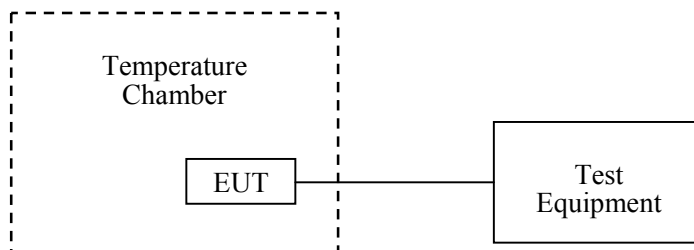
According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stays within the authorized frequency block.

**Test Procedure**

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: An external variable DC power supply was connected to the battery terminals of the equipment under test. The voltage was set from 85% to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the battery end point. The output frequency was recorded for each battery voltage.



**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Dongzhixu	High Temperature Test Chamber	DP1000	201105083-4	2016-09-10	2017-09-09
R&S	Universal Radio Communication Tester	CMU200	109 038	2017-07-18	2018-07-18
Pro instrument	DC Power Supply	pps3300	N/A	N/A	N/A
UNI-T	Multimeter	UT39A	M130199938	2017-04-02	2018-04-02
Unknown	Coaxial Cable	0.1m	C-1	Each Time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed traceable to National Primary Standards and International System of Units (SI).

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	25.4 °C
<b>Relative Humidity:</b>	53 %
<b>ATM Pressure:</b>	99.6 kPa

*The testing was performed by Leo Lv on 2017-08-03.*

**Cellular Band (Part 22H)**

GMSK, Middle Channel, $f_c = 836.6$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Limit
°C	V <sub>DC</sub>	Hz	ppm	ppm
-30	3.7	7	0.008	2.5
-20		2	0.002	
-10		2	0.002	
0		9	0.011	
10		8	0.010	
20		6	0.007	
30		6	0.007	
40		8	0.010	
50		6	0.007	
25	3.5	2	0.002	
25	4.2	6	0.007	



EDGE, Middle Channel, $f_c = 836.6$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Limit
°C	V <sub>DC</sub>	Hz	ppm	ppm
-30	3.7	6	0.007	2.5
-20		5	0.006	
-10		-1	-0.001	
0		-1	-0.001	
10		5	0.006	
20		3	0.004	
30		6	0.007	
40		3	0.004	
50		2	0.002	
25		3.5	4	
25	4.2	3	0.004	

PCS Band (Part 24E)

GMSK, Middle Channel, $f_c = 1880.0$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	V <sub>DC</sub>	Hz	ppm	
-30	3.7	13	0.007	Compliance
-20		10	0.005	
-10		10	0.005	
0		14	0.007	
10		7	0.004	
20		11	0.006	
30		14	0.007	
40		11	0.006	
50		14	0.007	
25		3.5	10	
25	4.2	9	0.005	

EDGE, Middle Channel, $f_c = 1880.0$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	$V_{DC}$	Hz	ppm	
-30	3.7	9	0.005	Compliance
-20		4	0.002	
-10		5	0.003	
0		9	0.005	
10		6	0.003	
20		5	0.003	
30		6	0.003	
40		5	0.003	
50		9	0.005	
25		3.5	9	
25	4.2	4	0.002	

**WCDMA Band II: R99**

Middle Channel, $f_c = 1880.0$ MHz				
Temperature	Voltage	Frequency Error	Frequency Error	Result
°C	$V_{DC}$	Hz	ppm	
-30	3.7	1	0.001	Compliance
-20		1	0.001	
-10		4	0.002	
0		3	0.002	
10		3	0.002	
20		4	0.002	
30		3	0.002	
40		5	0.003	
50		3	0.002	
25		3.5	6	
25	4.2	5	0.003	

**WCDMA Band V: R99**

<b>Middle Channel, <math>f_c = 836.6</math> MHz</b>				
<b>Temperature</b>	<b>Voltage</b>	<b>Frequency Error</b>	<b>Frequency Error</b>	<b>Limit</b>
<b>°C</b>	<b>V<sub>DC</sub></b>	<b>Hz</b>	<b>ppm</b>	<b>ppm</b>
-30	3.7	1	0.001	2.5
-20		2	0.002	2.5
-10		5	0.006	2.5
0		8	0.010	2.5
10		2	0.002	2.5
20		6	0.007	2.5
30		4	0.005	2.5
40		8	0.010	2.5
50		2	0.002	2.5
25		3.5	8	0.010
25	4.2	3	0.004	2.5

**\*\*\*\*\* END OF REPORT \*\*\*\*\***